typographical errors. There are appended "Results of the Exercises." We take leave of Mr. Muir with the hope that he may be soon called upon to revise his book, with a view to the issue of a second and succeeding editions.

Experimental Chemistry for Junior Students W. Emerson Reynolds. Part II. *Non-Metals.* (London: Longmans, Green and Co., 1882.)

THIS is a most excellent little book on experimental chemistry, and should be especially useful to medical students, for whom it is chiefly designed.

There is a very large amount of useful information and descriptions of experiments in clear, but not too commonplace language, to make a beginner using the book feel at any loss when he shall come to use a larger work. The experiments are numbered for reference, and are also in most cases explained by an equation in symbols.

The student who works through this book will certainly know something practical of chemistry, as it can scarcely be used as a cram book.

We notice that in some of the formulæ and equations the symbols are adorned with dashes, which it is to be hoped have been explained in the first part, otherwise they would be somewhat misleading, or at least confusing to students at the stage at which they commence to use the book.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

Vivisection

IN NATURE (vol. xxv. p. 482) there is a letter signed "Anna Kingsford," to which I feel compelled to reply. Not that I contemplate convincing your correspondent of her error, for I have only *facts* to offer; I write only for the unprejudiced portion of the English public, to protest with indignation against the calumnies regarding physiology and so-called vivisection, especially as practised here by Prof. Schiff.

The theoretical arguments for and against vivisection have been discussed to satiety; I wish to keep strictly to a question of facts, and the only passages in Mrs. Kingsford's letter against which I protest, are the words, "the *horrible tortures* perpetrated by Professors Schiff, Mantegazza, and Paul Bert"; "the atrocities of vivisection"; "the prolonged and exquisite torments to which domestic animals are subjected"; and other similar passages. In the first place, Mrs. Kingsford shows how ignorant she is of the subject she undertakes to enlighten the public upon, by mentioning Mantegazza as "a fair type" of a Continental vivisector, when the truth is that Mantegazza did long ago make some experiments on living animals, but has not done so for very many years, is, in fact, not a vivisector.

As I have not been in Prof. Paul Bert's laboratory, and have therefore not been an eye-witness of his methods, I will say nothing of the attack against him.

I now come to Prof. Schiff, who, of all living physiologists, is the one who carries out the most numerous experiments, and who may therefore fairly be taken as a typical representative of physiological research on the Continent. Having been for the last two years constantly in the learned professor's laboratory (and, I may add, in a perfectly independent position), I am able to give authoritative testimony as to his methods of study, and this testimony is, that *never* during this time was vivisection practised on a *feeling* animal; and I have repeatedly heard Prof. Schiff (whose word no one will dare to doubt) declare that he never in his life had operated on an animal that could feel pain —a fact which any one who knows this pre-eminently humane and kind man, will readily understand. I do not say that no vivisections are carried out; on the contrary, often several operations included under this comprehensive denomination are performed in one day, but *never* so as to cause pain. Either the animal is instantaneously killed by a puncture in the "medulla oblongata," and artificial respiration set up, or it is completely anæsthetised, and Prof. Schiff's first care is always to see that this has been properly done. The trial with the eyeball is a sure criterion. The anæsthetised animals are eventually killed in the same manner as the others, while still completely unconscious; few other dogs have such a painless death. In those cases where animals which have been operated on are kept alive for ulterior observations, the best proof that they do not suffer pain is the excellent appetite and healthy appearance of the dogs in the school of medicine here, where they are, moreover, excellently well-housed and fed, for Prof. Schiff says: "I like my dogs to be well cared for in every way." So much for the "horrible tortures" perpetrated on the continent.

I may be allowed to repeat a few words fallen from Prof. Schiff's mouth as characteristic of the man. On one occasion I heard him say: "I cannot bear the least pain being inflicted on animals;" on another, seeing me petting a dog which was to be experimented upon, he said: "one must never caress a dog before an operation, for otherwise, although one knows it feels no pain, one's hand is not steady for cutting."

It is true that there do exist experiments in which the animal must retain consciousness in order that the effects may be watched; but just because the animal would suffer pain, *these experiments are never carried out by Prof. Schiff.*

Prof. Schiff has repeatedly invited his calumniators (both publicly and privately) to come to his laboratory, which is open at every hour of the day to all who wish to form an unbiased opinion on the methods of vivisection, and to see with their own eyes the real facts of the case; not one has ever accepted this invitation—which shows how deep the love of truth is in some hearts.

B.SC., STUDENT OF MEDICINE

Geneva, April 6

Precious Coral

I WAS very much interested in Prof. Moseley's note on "Precious Coral," which appeared in NATURE (vol. xxv. p. 510). During, or rather after our deep-sea explorations in the Mediterranean, last summer, the *Washington* passed a week exploring the coral-yielding banks between Sicily and Cape Bon (Africa); we were also therefore on the coral-banks of Sciacea. Most of the coral I saw—I mean, of course, precious coral—was dead and blackened, and I saw large quantities in the same state, and from the same locality at Naples. At the extreme edge of the Sciacea bank is the extinct volcano, now covered with a few fathoms of water, known as Ferdinandea or Graham's Island. I believe that the eruption of that volcano may explain the quantities of dead coral around. As to the black colour, I am of opinion that it may be due to the decomposition of organic matter, rather than to the presence of binoxide of manganese; some of the bottom samples which I collected at various depths, turned quite black after a few weeks. The disappearance of the black colour on prolonged exposure to the sun, would, I believe, confirm my view. It must also be borne in mind that precious coral, in the Mediterranean at least, never is found in mud or in muddy waters, but grows mostly on a regular coral-rock formed by Madrepora of different species.

I have often heard of Japanese coral, and saw some fine samples at the International Fishery Exhibition of Berlin, in 1880; they came from Okinava, or Kotshi, where, in 1877, a quantity of the value of 9000 dollars was collected. It is this species which has been called *Corallium secundum* by Prof. Dana, if I am not mistaken.

A third species or variety of precious coral is found near the Cape de Verd Islands, especially San Jago; it has been distinguished by Prof. Targioni as *C. lubrani.*

As a *finale*, I may add that very little precious coral is found off Torre del Greco, from which place most of the coral fishermen hail, and in which place much of the coral collected is worked.

HENRY HILLYER GIGLIOLI

R. Istituto di Studi Superiori in Firenze, April 6

Phenological Observations on Early Flowers and Winter Temperatures

THE relation of temperature to the earliness of the season is too obvious to be overlooked, but methods of representing it numerically are of considerable interest. Since 1878 this has been done for about thirty stations in the United Kingdom by

observations on the first appearance of a selected series of thirty flowers. The results have been published in tabular form in the *Natural History Journal.* Thus the means for all the 900 observations (thirty plants at thirty stations) give an accurate comparison of the relative flowerings in different seasons. The values for the four years (1878-81), reckoning in days from January 1, are 93, 115, 103, and 111, respectively, giving a mean date of 105·3. It will be seen that, when such observations have been conducted over a sufficient period, important values can be deduced as to the relation between the mean temperature and the mean date of flowering; that is, between temperature and vegetable growth. The comparison ought, probably, to be made with the mean temperature of the six months from December to May, the flowers having been chosen so as to be all out by or near the close of the latter month.

That December (if not November) should be brought in will be apparent from the comparison of warmth and flowers in the following table:—Here the *total number of flowers found in bloom* is compared with the mean temperature for the *four, three,* and *two* preceding months. The flower observations were made in the Christmas holidays, at Street, Somerset, chiefly by myself; a few, however, were by friends at Bridgwater twelve miles to the west. The periods were, for the four weeks beginning about December 15; but began a week later, and lasted only three weeks, in 1879-80 and 1880-81. For these years, therefore, an addition has been made of about one-ninth of the number actually seen (31 and 82); as comparison with other years shows that to be the proportion added in the fourth week. Again, in the first season, 1876-7, only 20 flowers were seen at Street, for I then had no idea of the numbers to be found by a little searching. The correction is made by comparison with Sidcot, in the Mendips, eighteen miles N.E., where for the four seasons, 1877 to 1880, respectively, 59, 62, 16, and 13 wild flowers were noted in January. Possibly, more experience would have slightly enlarged the garden list.

The *temperatures* are supplied by Wm. S. Clark, whose observations go back over twenty-five years.

Season. Dec. to Jan.	Weeks.	Flowers.			Mean temperature.							
		Garden (kinds).	Wild species.	Total.	In the weeks of observation.	Sept.	Oct.	Nov.	Dec.	In the preceding		
										4 mos	3 mos	2 mos
1876-77	4	67	20	120	42·3	57·7	53·6	43·1	43·3	49·4	46·7	43·2
1877-78	4	80	55	135[1]	39·8	52·2	48·8	45·4	40·3	46·7	44·8	42·8
1878-79	4	20	8	28	33·0	57·7	51·7	38·6	31·4	44·9	40·6	35·0
1879-80	3	21	10	34[2]	45·6	56·4	50·4	39·3	31·0	44·4	40·2	35·2
1880-81	3	45	29	82[2]	37·3	59·9	45·0	42·5	43·4	47·8	43·6	43·0
1881-82	4	101	88	183[3]	41·0	55·5	46·1	49·0	40·2	47·7	45·1	44·6

Now, on comparing these numbers, we find that the plant totals do not vary precisely according to any of the eight temperature columns, though closely related to the last. That is, the amount of early and late flowering is most affected by the temperature of the last two months in the year. In 1880-1, the number of flowers was reduced by the severe frosts early in January, which practically cut off the last week of observation. The large number as compared to temperature in 1877-8, appears to be explained by the regular decrease of warmth, without any great cold to cut off autumn stragglers. The comparative fewness of these in the present season (40 out of 88) should be ascribed to the abundance of new-comers.

That the weather *during* the period is of less effect than that of the previous months, is evident by comparing this season with 1879-80, when the three weeks were the warmest of any season under consideration.

We have already seen that the Sidcot observations confirm those at Street, the totals, though different, not varying very greatly. The same is true of observations in Devon and Cornwall, where in 1876-7 Mr. W. B. Waterfall observed 103 wild flowers (N. H. J., vol. i. No. 1), whilst this year Mr. Wm. Waterfall has kindly sent me a list of 119. Twenty-five fresh ones have been observed, although eleven others were not again recorded, "but they would no doubt be in bloom if looked for in the same locality."

[1] Corrected by comparison with the Sidcot list.
[2] Corrected by allowance of ⅓ for an extra week.
[3] Six flowers being contained both in wild and garden list, deduction is made in the total accordingly.

He also makes the following comparisons of date for four common flowers, to which I append the same, so far as recorded, for Street, Somerset.

	Devon and Cornwall.			Street, Somerset.		
	1876-7	1880-1	1881-2	1876-7	1880-1	1881-2
Hazel	Jan. 15	Dec. 18	Dec. 26	Jan. 16	Jan. 1	Dec. 28
Celandine ...	Jan 16	Dec. 25	Dec. 25	Jan. 12	Dec. 25	Dec. 30
Ground Ivy...	Feb. 16	Dec. 25	Jan. 19	Jan.	Mar. 22	Jan. 31 (about)
Draba verna...	Jan. 4	Dec. 25	Dec. 12			Jan. 7
Average from Dec. 1	Jan. 18	Dec. 23	Dec. 28			Jan. 8

The comparative dates show even more clearly than the totals how remarkably forward the early part of the present season was compared with 1876-7, whilst the corresponding part of the foregoing season, previous to the severe weather, was still more advanced.

As regards classification, it is curious to notice that only three (wild flowers) were endogenous, the snowdrop and two grasses, *Poa annua* and *Triticum repens.* The following is a complete list under the various natural orders; S. stands for *Spring* blossom, R. for Remaniés (101 garden flowers were seen also).

EXOGENS.

Ranunculaceæ.
Anemone nemorosa, S.
Ranunculus acris, R.
,, repens, R.
,, bulbosus, R.
,, Ficaria, S.
Fumariaceæ.
Fumaria officinalis, R.
Cruciferæ.
Cheiranthus Cheiri, S.
Sinapis arvensis, R.
Arabis thaliana, S.
Barbarea vulgaris, R.
Nasturtium officinale, R.
Draba verna, S.
Capsella Bursa-pastoris, R. and S.
Senebiera Coronopus, R.
Lepidium campestre, R.
Violaceæ.
Viola odorata, S.
,, canina, S.
,, tricolor, R. and S.
Caryophyllaceæ.
Lychnis diurna, R. and S.
Cerastium triviale, R. and S.
Stellaria media, S.
,, Holostea, S.
Hypericaceæ.
Hypericum quadrangulum, R.
Malvaceæ.
Malva sylvestris, R.
Geraniaceæ.
Geranium molle, S.
,, Robertianum, R.
Leguminiferæ.
Ulex europæus, S.
Trifolium repens, R.
,, agrarium, R.
Rosaceæ.
Potentilla Fragariastrum, S.
Rubus fruticosus, R.
Prunus spinosa, S.
Fragaria vesca, S.
Geum urbanum, R.
Crassulaceæ.
Sedum acre, S.
Cotyledon acre, S.
Umbelliferæ.
Silaus pratensis, R.
Apium graveolens, R.
Heracleum Sphondylium, R.
Scandix Pecten-Veneris, S.
Conium maculatum, R. and S.
Araliaceæ.
Hedera Helix, R.
Rubiaceæ.
Galium Mollugo, R.
Dipsaceæ.
Dipsacus sylvestris, R.
Scabiosa arvensis, S.
Compositæ.
Silybum Marianum, R.
Chrysanthemum Leucanthemum, R.
Achillea Millefolium, R.
Senecio vulgaris, S.
,, Jacobæa, R.
Matricaria Chamomilla, R.
Bellis perennis, S.
Hypochœris glabra, R.
Leontodon autumnalis, R.
Crepis virens, R.
Hieracium umbellatum, R.
,, murorum, R.
Taraxacum Dens-Leonis, S.
Apocynaceæ.
Vinca major, S.
,, minor, S.
Scrophulariaceæ.
Linaria spuria, R.
,, Cymbalaria, S.
Veronica agrestis, S.
,, Buxbaumii, S.
,, arvensis, S.
,, serpyllifolia, S.
,, Chamædrys, S.
Labiatæ.
Stachys sylvatica, R.
Lamium purpureum, S.
,, album, S.
,, Galeobdolon, R.
Ajuga reptans, R.
Calamintha officinalis, R.
Boraginaceæ.
Myosotis arvensis, S.
Borago officinalis, S.
Primulaceæ.
Primula vulgaris, S.
Polygonaceæ.
Rumex obtusifolius, R.

Thymelaceæ.	*Amentiferæ.*
Daphne Laureola, S.	Corylus Avellana, S.
Euphorbiaceæ.	
Euphorbia Peplus, S.	ENDOGENS.
,, Helioscopia, S.	*Liliaceæ.*
Mercurialis perennis, S.	Galanthus nivalis, S.
Urticaceæ.	*Gramineæ.*
Parietaria diffusa, R.	Poa annua, S.
Urtica urens, S.	Triticum repens, R.

In conclusion, my object in presenting these notes to your readers is threefold; first, to suggest an agreeable, easy, and yet useful occupation for winter walks; second, to indicate the value for phenological purposes if a great number of such series of observations could be made for a long series of years at various parts of our country; third, to show how great is the difference, even within the limits of the British Isles,[1] in the time of flowering of common plants, and yet how little we know upon the subject. Should any desire to assist in work of this kind, I would gladly forward free a copy of our printed form, containing lists and suggestions for observations, both of flora and fauna. The work is carried on in connection with the phenological branch of the Meteorological Society, of which the Rev. T. A. Preston, M.A., of Marlboro', is the efficient Secretary.

Bootham, York J. EDMUND CLARK

Colours of Low-growing Wood Flowers

NO one can enter our English woods just now without being struck with the lovely way in which they are starred with the yellow of the primrose, the white of the anemone and strawberry, and the light blue of the dog violet. It will be noticed that the tints of these flowers seem positively to shine in the low herbage and among the semi-shade of the trees and bushes. After twice going through the descriptions of flowers growing in similar situations, given in Hooker's "Student's Flora of the British Islands," I find that nearly all our dwarf wood flowers are white, light yellow, and light blue. None appear to be red. Three are purple—one form of the Sweet Violet and the Ground Ivy (*Nepeta Glechoma*), both of which are scented; and the Bugle (*Ajuga reptans*).

If the white and yellow tints of flowers fertilised by night-moths are of service in guiding the moths to them, may not the like tints in low plants in thickets and woods be similarly advantageous to the plants by tending to secure fertilisation? The more lordly foxglove, the ragged robin, and other higher growing flowers, erect above the low herbage, and enjoying more light, are conspicuous enough, but how would a small flower of the colour of a foxglove attract attention when hid among the grass? The purple of the bugle I cannot account for. The ground ivy has a pungent scent. The purple of the sweet violet is certainly inconspicuous, but here the scent may be the attraction, or the habit of the plant in forming cleistogamous flowers, may secure its multiplication. Hence it may be questioned whether the white form of the sweet violet does not mark a gradual transition towards that colour. If the white forms are more conspicuous, and ecure easier cross fertilisation, they may in time preponderate. Perhaps the existence of the sweet violet in the purple and in the white form may throw light on the origin of the general lightness of tint in dwarf wood subjects.

The low flowers in dark places which were lighter and made themselves best seen, would more readily secure fertilisation, and through natural selection would tend to have still paler tints. The change might be aided by the bleaching of flowers in shade, as described by Mr. J. C. Costerus (NATURE, vol. xxv. p. 482). In this connection it may be noted that the wood anemone has a rare purple form—perhaps a survival—and that *Anemone Apennina* is light blue. The Potentillas, close allies of the strawberry, but mainly growing in the open, have as a rule yellow flowers; sometimes red ones. The various mountain primroses of this and other countries, and those that grow in meadows (like our own Bird's Eye Primrose, *primula formosa*), have mostly reddish, lilac, or rosy flowers. The common primrose, when growing in exposed hedgebanks has often reddish, lilac, or purple flowers. Its sports in cultivation are often white, so it may be progressing towards that tint in woods. The cowslip, which grows in meadows, has a deeper tinge of yellow than the ox-lip, which grows in copses. The cowslip is also far darker than the primrose, and sometimes has a scarlet or orange-brown corolla—perhaps the germ of the dark rich polyanthus of our gardens. The primrose family may have originated in woods, and have been originally light, gradually darkening as the flowers multiplied in the open; or, which is more probable, the tribe originated in exposed situations, creeping by slow degrees into the woods, and bleaching as it went.

Bexley, March 30 J. INNES ROGERS

Vignettes from Nature

MR. BUDDEN is perfectly right in querying the locality of the specimens of sharks' teeth which I mentioned as having seen from a South American digging. In consequence of a slight deafness, I misunderstood my friend's account of them; and knowing them to be American, assigned the word "South" to "America," instead of to "Carolina," in the coprolite pits of which they were found. WILLIAM B. CARPENTER

ECONOMIC GEOLOGY OF INDIA[1]

II.

IN a former notice of Prof. Valentine Ball's important work on the "Economic Geology of India," the subjects of the gold supply and of that form of carbon known as the diamond, were treated of. In the present notice it is proposed to give a brief account of that more important form of carbon known as coal, as well as to allude to the valuable information given in the chapters on Iron, Salt, and Building-stone. The rocks, which in Peninsular India probably correspond, as regards the time of their formation, to the true carboniferous rocks of Europe, are not coal-bearing, and the oldest coal-measures in the country belong to a period which is well included within the limits of the Upper Palæozoic or Permian, and the Lower Jurassic formations. All the useful coal of the peninsula may conveniently be described as being of Permio-Triassic age, and, with two exceptions, it may be added, these measures do not occur beyond the limits of the peninsula. In the extra-peninsular area, coal is found in various younger deposits, and there are numerous deposits in Afghanistan, the Punjab, at the foot of the Himalayas, in Assam and Burma, of undoubted Lower Tertiary, Nummulitic, or Eocene coals and lignites; but it is only quite exceptional that such deposits possess any great value (the chief noteworthy exceptions occur in Assam and Burma).

According to the somewhat liberal estimates of Mr. Hughes, the areas in India, in which coal-measures occur, including those unsurveyed, amount in all to 35,000 square miles, but the thickness of a vast number of the seams of coal in these basins is very varied. For over one century the coal-mining industry of India has been in operation, and there has been a steady increase in production and consumption, especially within the last ten years. Still the coal resources of the country cannot be regarded as yet developed. Out of over thirty distinct coal-fields in Peninsular India, only four or five are worked at all, and even of these, but two have arrived at an output of from 1 to 2000 tons a day, and this though in these two fields the coal-pits are numerous.

It is very important that the reasons for this state of things should be well understood, and they are not far to seek. Most of the coal-fields are very remote from the centres of manufacture and from the seaports, and at these places the native produce has to compete with a better quality of coal sea-borne from Europe. With the extension of railways in India, the home coal will have a better chance, as the facilities of carriage will enable the coal to be brought to the iron-mines, which are mostly too at long distances from the ports, and when used in the reduction of metallic ores, the demand for coal would increase.

[1] At Wigton, Cumberland, for instance, although on the West coast, Mr. J. E. Walker noticed only *fourteen* wild flowers.

[1] "A Manual of the Geology of India. Part III. Economic Geology." By V. Ball, M.A., F.G.S., Officiating Deputy Superintendent, Geological Survey of India. Published by order of the Government of India. (Calcutta, 1881.) Continued from p. 510.